CUSTOMER : .

DATE : .

REV : .

SPECIFICATIONS FOR APPROVAL

Top View Type White SMD LED

MODEL NAME : LEMWS59S80*Z***B

RoHS Compliant

Halogen Free

APPROVAL	REMARK	APPENDIX

DESIGNED	CHECKED	APPROVED

LG Innotek

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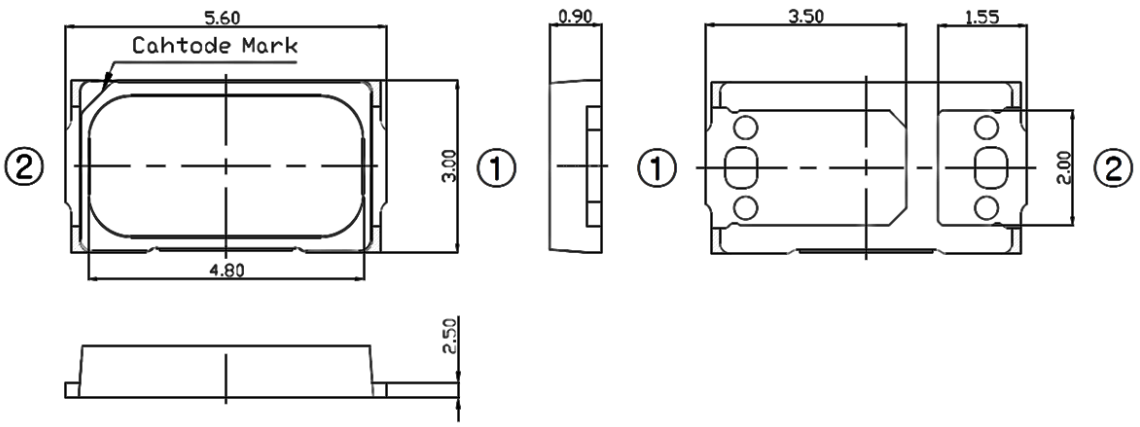
Appendix. Nomenclature of Package

1. Features

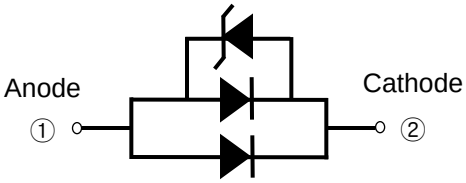
- Lighting Color : White
- Lead Frame Type LED Package : 5.6×3.0×0.9 mm (L×W×H) [Unit : mm]
- Viewing Angle : 120˚
- Chip Material : InGaN
- Soldering Methods : Reflow Soldering
- Taping : 12 mm conductive carrier tape & antistatic clear cover tape
  3,000 pcs/reel, Φ178 mm Reel

2. Outline Dimensions

(Unit : mm)

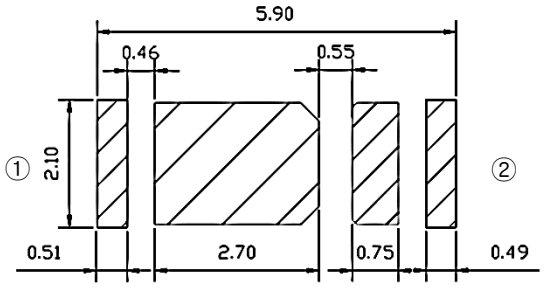


Internal circuit



Pad Configuration
① Anode Pad
② Cathode Pad

Recommendable soldering pattern
(For reflow soldering)



▪ Tolerances unless otherwise specified ±0.10 mm

3. Applications

- Interior and Exterior Illumination

4. Absolute Maximum Ratings

(Ta=25℃)

Item	Symbol	Rating	Unit
Forward Current	If	200	mA
Pulse Forward Current*1)	Ifp	260	mA
Operating Temperature	Topr	-40 ~ +85	℃
Storage Temperature	Tstg	-40 ~ +100	℃
Junction Temperature	Tj	125	℃
Soldering Temperature	JEDEC-J-STD-020D		
ESD Classification	Class 2 (ANSI/ESDA/JEDEC JS-001)		

*1) Pulse width ≤10ms and duty cycle ≤10%

※ Operating the LED beyond the listed maximum ratings may affect device reliability and cause permanent damage. These or any other conditions beyond those indicated under recommended operating conditions are not implied. The exposure to the absolute maximum rated conditions may affect device reliability.

※ The LEDs are not designed to be driven in reverse bias.

5. Electro - Optical Characteristics

(Ta=25℃)

Item	Symbol	Condition	CCT	Min.	Typ.	Max.	Unit
Luminous Flux I[1)]	Φv	If =65mA	6500 (F)	35.4	-	39.2	lm
			5700 (G)	35.8	-	39.6	
			5000 (H)	36.1	-	39.9	
			4000 (J)	34.9	-	38.4	
			3500 (K)	34.2	-	37.7	
			3000 (L)	33.8	-	37.3	
			2700 (M)	32.2	-	35.6	
Luminous Flux II[2)]			6500 (F)	33.7	-	37.3	
			5700 (G)	34.1	-	37.7	
			5000 (H)	34.4	-	38.0	
			4000 (J)	33.2	-	36.6	
			3500 (K)	32.6	-	35.9	
			3000 (L)	32.2	-	35.5	
			2700 (M)	30.7	-	33.9	
Forward Voltage	Vf	If =65mA	All	2.65	-	2.90	V
Color Coordinate	Cx / Cy	If =65mA	All	Refer to "Chromaticity Bins"			-
Color Rendering Index (CRI)	Ra	If =65mA	All	80.0	-	-	-
Viewing Angle	2Θ1/2	If =65mA	All	-	120	-	deg
Typical Temperature Coefficient of Forward Voltage*3)	ΔVf / ΔTj	If =65mA	All	-1.0	-	-3.0	mV/℃
Thermal Resistance, Junction to Solder Point	Rth j-s	If =65mA	All	-	10	-	℃/W

*1) These values are measured by a standard of LED component level

*2) These values are measured by a standard of assembly level

*3) Measured at Ta between 25℃ and 85℃

※ These values are measured by the LG Innotek optical spectrum analyzer within the following tolerances. Luminous Flux (Φv) : ±7%, Forward Voltage (Vf) : ±0.1V, Color Value : ±0.005, CRI Value : ±2,

※ Although all LEDs are tested by LG Innotek equipment, some values may vary slightly depending on the conditions of the test equipment.

5. Electro - Optical Characteristics

▪ By a standard of component level

(Ta=25℃)

CRI	CCT (K)	If (mA)	Vf (V)	Power (W)	Φv (lm)	lm/W
80	6500	30	2.65	0.080	18.0	225
		65	2.72	0.177	38.2	216
		100	2.78	0.278	57.6	207
		150	2.86	0.429	83.8	195
		200	2.94	0.588	108.7	185
	5700	30	2.65	0.080	18.2	227
		65	2.72	0.177	38.6	218
		100	2.78	0.278	58.2	209
		150	2.86	0.429	84.7	197
		200	2.94	0.588	109.8	187
	5000	30	2.65	0.080	18.3	229
		65	2.72	0.177	38.9	220
		100	2.78	0.278	58.7	211
		150	2.86	0.429	85.3	199
		200	2.94	0.588	110.7	188
	4000	30	2.65	0.080	17.7	221
		65	2.72	0.177	37.5	212
		100	2.78	0.278	56.5	203
		150	2.86	0.429	82.3	192
		200	2.94	0.588	106.7	181
	3500	30	2.65	0.080	17.3	217
		65	2.72	0.177	36.8	208
		100	2.78	0.278	55.5	200
		150	2.86	0.429	80.7	188
		200	2.94	0.588	104.7	178
	3000	30	2.65	0.080	17.2	214
		65	2.72	0.177	36.4	206
		100	2.78	0.278	54.9	197
		150	2.86	0.429	79.9	186
		200	2.94	0.588	103.6	176
	2700	30	2.65	0.080	15.9	199
		65	2.72	0.177	34.7	196
		100	2.78	0.278	52.8	190
		150	2.86	0.429	77.7	181
		200	2.94	0.588	101.6	173

5. Electro - Optical Characteristics

▪ By a standard of assembly level

(Ta=25℃)

CRI	CCT (K)	If (mA)	Vf (V)	Power (W)	Φv (lm)	lm/W
80	6500	30	2.65	0.080	17.1	214
		65	2.72	0.177	36.4	206
		100	2.78	0.278	54.9	197
		150	2.86	0.429	79.8	186
		200	2.94	0.588	103.5	176
	5700	30	2.65	0.080	17.3	217
		65	2.72	0.177	36.8	208
		100	2.78	0.278	55.4	199
		150	2.86	0.429	80.6	188
		200	2.94	0.588	104.6	178
	5000	30	2.65	0.080	17.5	218
		65	2.72	0.177	37.0	209
		100	2.78	0.278	55.9	201
		150	2.86	0.429	81.3	189
		200	2.94	0.588	105.4	179
	4000	30	2.65	0.080	16.8	210
		65	2.72	0.177	35.7	202
		100	2.78	0.278	53.9	194
		150	2.86	0.429	78.3	183
		200	2.94	0.588	101.6	173
	3500	30	2.65	0.080	16.5	206
		65	2.72	0.177	35.0	198
		100	2.78	0.278	52.8	190
		150	2.86	0.429	76.9	179
		200	2.94	0.588	99.7	170
	3000	30	2.65	0.080	16.3	204
		65	2.72	0.177	34.7	196
		100	2.78	0.278	52.3	188
		150	2.86	0.429	76.0	177
		200	2.94	0.588	98.6	168
	2700	30	2.65	0.080	15.1	189
		65	2.72	0.177	33.0	187
		100	2.78	0.278	50.3	181
		150	2.86	0.429	74.0	172
		200	2.94	0.588	96.8	165

6. Bins Structure and Order Code

(Ta=25℃, @65mA)

CRI	CCT [K]	Luminous Flux Bins	Model Name
		P7	
80	6500 (F) *1)	36.6~39.2	LEMWS59S**80F**Z***B
	6500 (F) *2)	34.9~37.3	
	5700 (G)	37.0~39.6	LEMWS59S**80G**Z***B
		35.3~37.7	
	5000 (H)	37.3~39.9	LEMWS59S**80H**Z***B
		35.5~38.0	
	4000 (J)	36.0~38.4	LEMWS59S**80J**Z***B
		34.3~36.6	
	3500 (K)	35.3~37.7	LEMWS59S**80K**Z***B
		33.6~35.9	
	3000 (L)	34.9~37.3	LEMWS59S**80L**Z***B
		33.2~35.5	
	2700 (M)	33.2~35.6	LEMWS59S**80M**Z***B
		31.7~33.9	

*1) These values are measured by a standard of LED component level
*2) These values are measured by a standard of assembly level

▪ Forward Voltage Bins (@65mA)

Bin	Vf (V)	
	Min.	Max.
7B	2.65	2.70
8A	2.70	2.75
8B	2.75	2.80
9A	2.80	2.85
9B	2.85	2.90

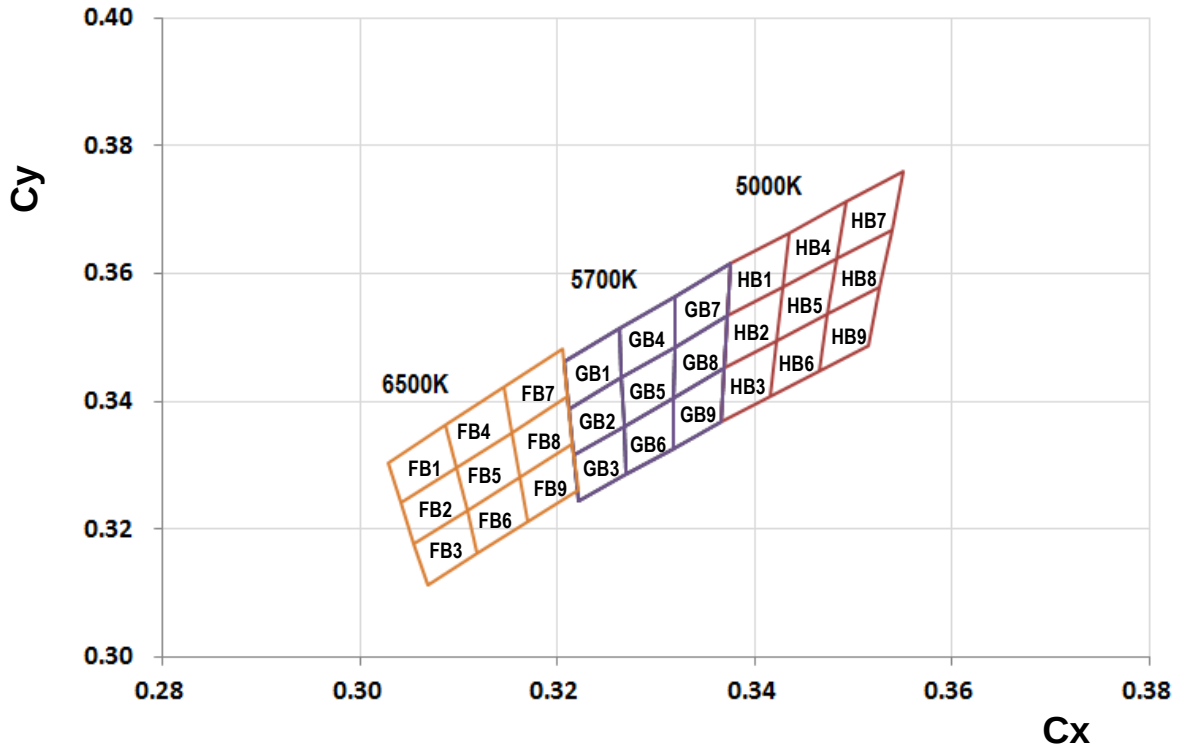
※ Bin structure : Please refer to the following example.
Bin Code : P7–FB1–8A
(Φv Bin = P7, Color Bin = FB1, Vf Bin = 8A)

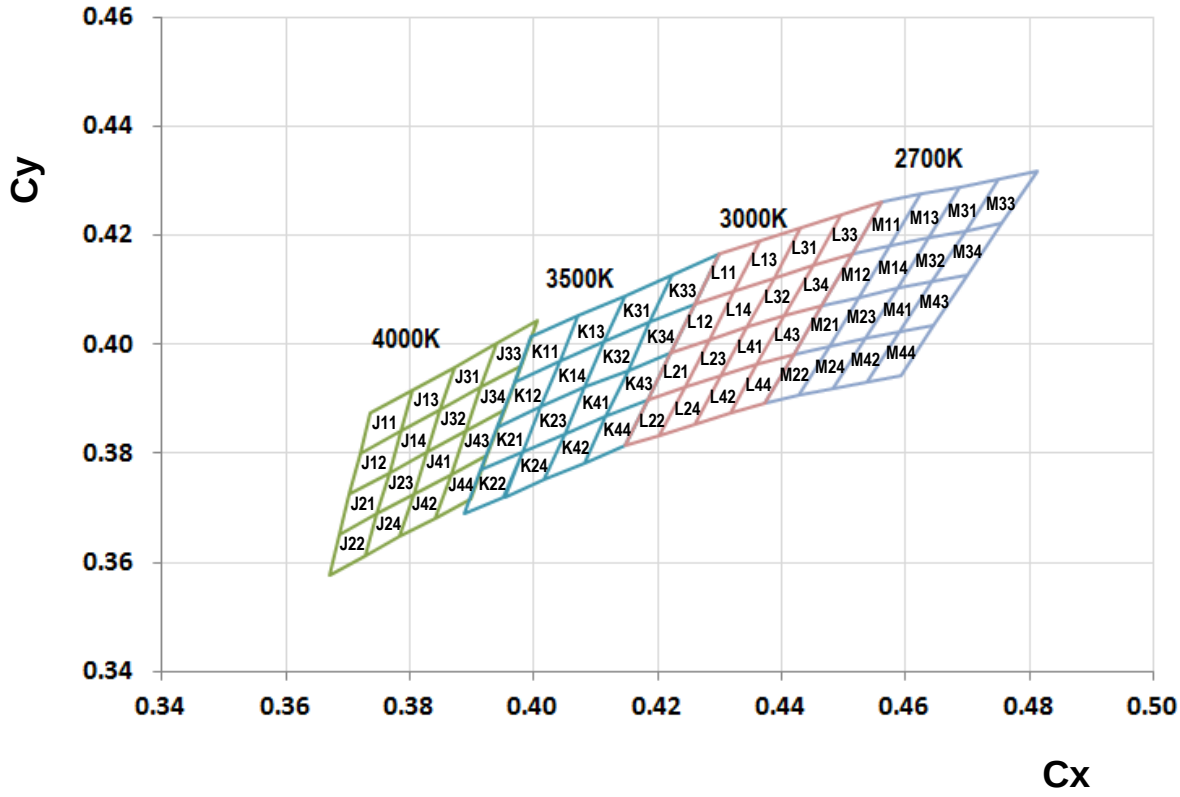
▪ CRI Bins (@65mA)

Bin	CRI	
	Min.	Max.
80	80	-

6. Bins Structure and Order Code

- Color Bins (@65mA)





6. Bins Structure and Order Code

▪ Color Bins (@65mA)

※ Ansi Bin

5000K			5700K			6500K		
Bin	Cx	Cy	Bin	Cx	Cy	Bin	Cx	Cy
HB1	0.3376	0.3616	**GB1**	0.3207	0.3462	**FB1**	0.3028	0.3304
	0.3434	0.3664		0.3263	0.3513		0.3087	0.3363
	0.3428	0.3579		0.3266	0.3437		0.3098	0.3296
	0.3373	0.3534		0.3212	0.3389		0.3041	0.3240
HB2	0.3373	0.3534	**GB2**	0.3212	0.3389	**FB2**	0.3041	0.3240
	0.3428	0.3579		0.3266	0.3437		0.3098	0.3296
	0.3422	0.3494		0.3268	0.3361		0.3108	0.3229
	0.3369	0.3451		0.3217	0.3316		0.3055	0.3177
HB3	0.3369	0.3451	**GB3**	0.3217	0.3316	**FB3**	0.3055	0.3177
	0.3422	0.3494		0.3268	0.3361		0.3108	0.3229
	0.3416	0.3408		0.3270	0.3285		0.3119	0.3162
	0.3366	0.3369		0.3222	0.3243		0.3068	0.3113
HB4	0.3434	0.3664	**GB4**	0.3263	0.3513	**FB4**	0.3087	0.3363
	0.3493	0.3712		0.3320	0.3565		0.3146	0.3422
	0.3484	0.3624		0.3319	0.3485		0.3154	0.3352
	0.3428	0.3579		0.3266	0.3437		0.3098	0.3296
HB5	0.3428	0.3579	**GB5**	0.3266	0.3437	**FB5**	0.3098	0.3296
	0.3484	0.3624		0.3319	0.3485		0.3154	0.3352
	0.3474	0.3536		0.3319	0.3406		0.3162	0.3282
	0.3422	0.3494		0.3268	0.3361		0.3108	0.3229
HB6	0.3422	0.3494	**GB6**	0.3268	0.3361	**FB6**	0.3108	0.3229
	0.3474	0.3536		0.3319	0.3406		0.3162	0.3282
	0.3465	0.3448		0.3318	0.3327		0.3170	0.3212
	0.3416	0.3408		0.3270	0.3285		0.3119	0.3162
HB7	0.3493	0.3712	**GB7**	0.3320	0.3565	**FB7**	0.3146	0.3422
	0.3551	0.3760		0.3376	0.3616		0.3205	0.3481
	0.3539	0.3669		0.3373	0.3534		0.3210	0.3408
	0.3484	0.3624		0.3319	0.3485		0.3154	0.3352
HB8	0.3484	0.3624	**GB8**	0.3319	0.3485	**FB8**	0.3154	0.3352
	0.3539	0.3669		0.3373	0.3534		0.3210	0.3408
	0.3527	0.3578		0.3369	0.3451		0.3216	0.3334
	0.3474	0.3536		0.3319	0.3406		0.3162	0.3282
HB9	0.3474	0.3536	**GB9**	0.3319	0.3406	**FB9**	0.3162	0.3282
	0.3527	0.3578		0.3369	0.3451		0.3216	0.3334
	0.3515	0.3487		0.3366	0.3369		0.3221	0.3261
	0.3465	0.3448		0.3318	0.3327		0.3170	0.3212

6. Bins Structure and Order Code

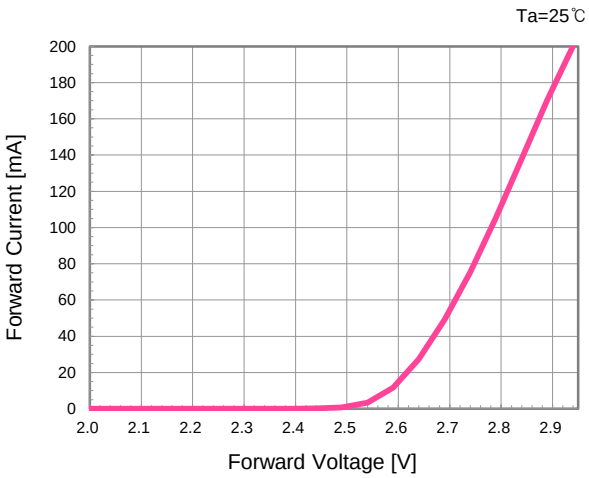
▪ Color Bins (@65mA)

※ Ansi Bin

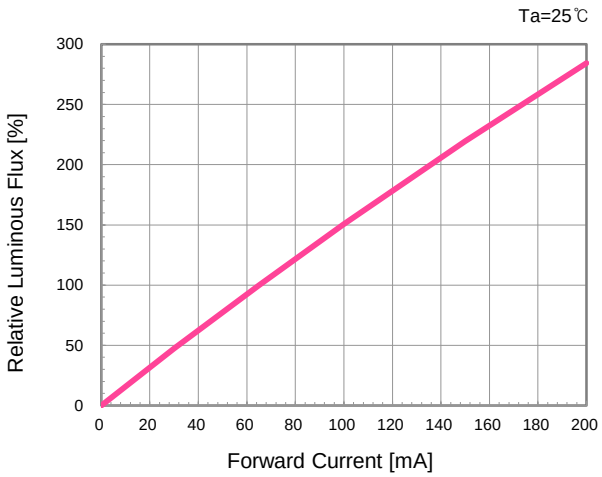
2700K			3000K			3500K			400K		
Rank	**CIE X**	**CIE Y**	**Rank**	**CIE X**	**CIE Y**	**Rank**	**CIE X**	**CIE Y**	**Rank**	**CIE X**	**CIE Y**
M11	0.4562	0.4260	**L11**	0.4299	0.4165	**K11**	0.3996	0.4015	**J11**	0.3736	0.3874
	0.4625	0.4275		0.4364	0.4189		0.4071	0.4052		0.3804	0.3917
	0.4575	0.4181		0.4323	0.4098		0.4041	0.3969		0.3785	0.3841
	0.4513	0.4166		0.4260	0.4075		0.3969	0.3932		0.3720	0.3800
M12	0.4513	0.4166	**L12**	0.4260	0.4075	**K12**	0.3969	0.3932	**J12**	0.3720	0.3800
	0.4575	0.4181		0.4323	0.4098		0.4041	0.3969		0.3785	0.3841
	0.4525	0.4087		0.4282	0.4008		0.4012	0.3885		0.3766	0.3765
	0.4465	0.4071		0.4221	0.3984		0.3941	0.3848		0.3703	0.3726
M13	0.4625	0.4275	**L13**	0.4364	0.4189	**K13**	0.4071	0.4052	**J13**	0.3804	0.3917
	0.4687	0.4289		0.4430	0.4212		0.4146	0.4089		0.3871	0.3959
	0.4637	0.4196		0.4387	0.4122		0.4114	0.4005		0.3849	0.3881
	0.4575	0.4181		0.4323	0.4098		0.4041	0.3969		0.3785	0.3841
M14	0.4575	0.4181	**L14**	0.4323	0.4098	**K14**	0.4041	0.3969	**J14**	0.3785	0.3841
	0.4637	0.4196		0.4387	0.4122		0.4114	0.4005		0.3849	0.3881
	0.4586	0.4103		0.4344	0.4032		0.4082	0.3922		0.3828	0.3803
	0.4525	0.4087		0.4282	0.4008		0.4012	0.3885		0.3766	0.3765
M21	0.4465	0.4071	**L21**	0.4221	0.3984	**K21**	0.3941	0.3848	**J21**	0.3703	0.3726
	0.4525	0.4087		0.4282	0.4008		0.4012	0.3885		0.3766	0.3765
	0.4477	0.3996		0.4243	0.3921		0.3982	0.3803		0.3746	0.3689
	0.4419	0.3982		0.4184	0.3899		0.3915	0.3769		0.3687	0.3652
M22	0.4419	0.3982	**L22**	0.4184	0.3899	**K22**	0.3915	0.3769	**J22**	0.3687	0.3652
	0.4477	0.3996		0.4243	0.3921		0.3982	0.3803		0.3746	0.3689
	0.4428	0.3906		0.4203	0.3834		0.3950	0.3721		0.3727	0.3613
	0.4373	0.3893		0.4147	0.3814		0.3889	0.3690		0.3670	0.3578
M23	0.4525	0.4087	**L23**	0.4282	0.4008	**K23**	0.4012	0.3885	**J23**	0.3766	0.3765
	0.4586	0.4103		0.4344	0.4032		0.4082	0.3922		0.3828	0.3803
	0.4535	0.4011		0.4302	0.3943		0.4050	0.3837		0.3806	0.3725
	0.4477	0.3996		0.4243	0.3921		0.3982	0.3803		0.3746	0.3689
M24	0.4477	0.3996	**L24**	0.4243	0.3921	**K24**	0.3982	0.3803	**J24**	0.3746	0.3689
	0.4535	0.4011		0.4302	0.3943		0.4050	0.3837		0.3806	0.3725
	0.4483	0.3918		0.4260	0.3853		0.4017	0.3752		0.3784	0.3647
	0.4428	0.3906		0.4203	0.3834		0.3953	0.3721		0.3727	0.3613
M31	0.4687	0.4289	**L31**	0.4430	0.4212	**K31**	0.4146	0.4089	**J31**	0.3871	0.3959
	0.4750	0.4304		0.4496	0.4236		0.4223	0.4127		0.3939	0.4002
	0.4697	0.4209		0.4450	0.4144		0.4187	0.4040		0.3915	0.3922
	0.4637	0.4196		0.4387	0.4122		0.4114	0.4005		0.3849	0.3881
M32	0.4637	0.4196	**L32**	0.4387	0.4122	**K32**	0.4114	0.4005	**J32**	0.3849	0.3881
	0.4697	0.4209		0.4450	0.4144		0.4187	0.4040		0.3915	0.3922
	0.4643	0.4115		0.4404	0.4052		0.4151	0.3953		0.3890	0.3842
	0.4586	0.4103		0.4344	0.4032		0.4082	0.3922		0.3828	0.3803
M33	0.4750	0.4304	**L33**	0.4496	0.4236	**K33**	0.4223	0.4127	**J33**	0.3939	0.4002
	0.4813	0.4319		0.4562	0.4260		0.4299	0.4165		0.4006	0.4044
	0.4756	0.4223		0.4513	0.4166		0.4260	0.4075		0.3979	0.3962
	0.4697	0.4209		0.4450	0.4144		0.4187	0.4040		0.3915	0.3922
M34	0.4697	0.4209	**L34**	0.4450	0.4144	**K34**	0.4187	0.4040	**J34**	0.3915	0.3922
	0.4756	0.4223		0.4513	0.4166		0.4260	0.4075		0.3979	0.3962
	0.4700	0.4126		0.4465	0.4071		0.4221	0.3984		0.3952	0.3880
	0.4643	0.4115		0.4404	0.4052		0.4151	0.3953		0.3890	0.3842
M41	0.4586	0.4103	**L41**	0.4344	0.4032	**K41**	0.4082	0.3922	**J41**	0.3828	0.3803
	0.4643	0.4115		0.4404	0.4052		0.4151	0.3953		0.3890	0.3842
	0.4590	0.4023		0.4360	0.3962		0.4117	0.3868		0.3866	0.3762
	0.4535	0.4011		0.4302	0.3943		0.4050	0.3837		0.3806	0.3725
M42	0.4535	0.4011	**L42**	0.4302	0.3943	**K42**	0.4050	0.3837	**J42**	0.3806	0.3725
	0.4590	0.4023		0.4360	0.3962		0.4117	0.3868		0.3866	0.3762
	0.4538	0.3931		0.4316	0.3873		0.4082	0.3783		0.3841	0.3682
	0.4483	0.3918		0.4260	0.3853		0.4017	0.3752		0.3784	0.3647
M43	0.4643	0.4115	**L43**	0.4404	0.4052	**K43**	0.4151	0.3953	**J43**	0.3890	0.3842
	0.4700	0.4126		0.4465	0.4071		0.4221	0.3984		0.3952	0.3880
	0.4646	0.4035		0.4419	0.3982		0.4184	0.3899		0.3925	0.3798
	0.4590	0.4023		0.4360	0.3962		0.4117	0.3868		0.3866	0.3762
M44	0.4590	0.4023	**L44**	0.4360	0.3962	**K44**	0.4117	0.3868	**J44**	0.3866	0.3762
	0.4646	0.4035		0.4419	0.3982		0.4184	0.3899		0.3925	0.3798
	0.4593	0.3944		0.4373	0.3893		0.4147	0.3814		0.3898	0.3716
	0.4538	0.3931		0.4316	0.3873		0.4082	0.3783		0.3841	0.3682

7. Typical Characteristic Curves

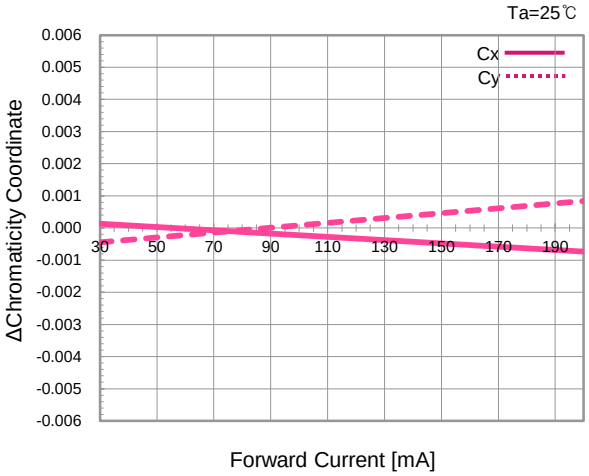
▪ Forward Current vs. Forward Voltage



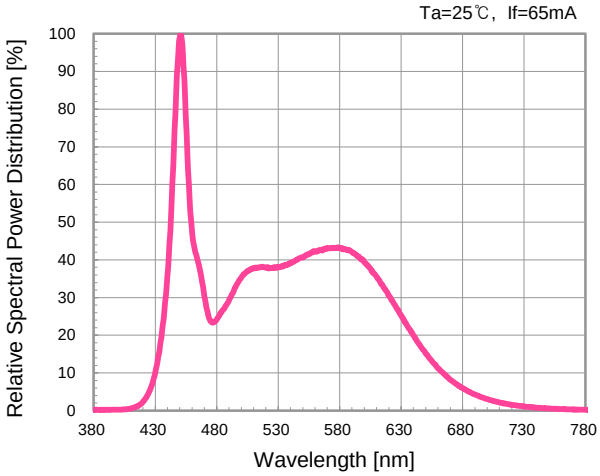
▪ Relative Luminous Flux vs. Forward Current



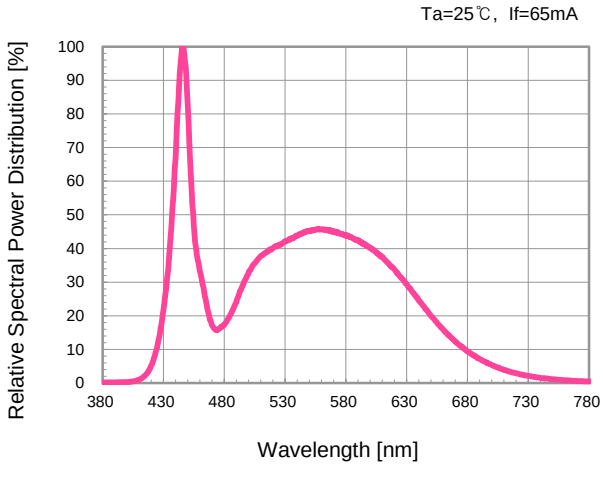
▪ Chromaticity Coordinate vs. Forward Current



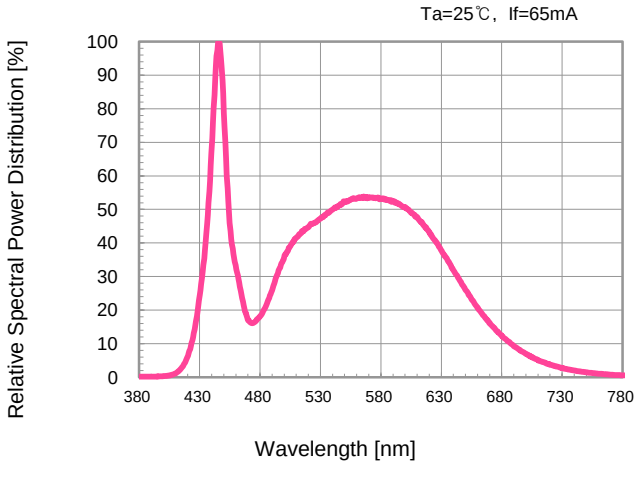
▪ Spectrum (6500K (F))



▪ Spectrum (5700K (G))



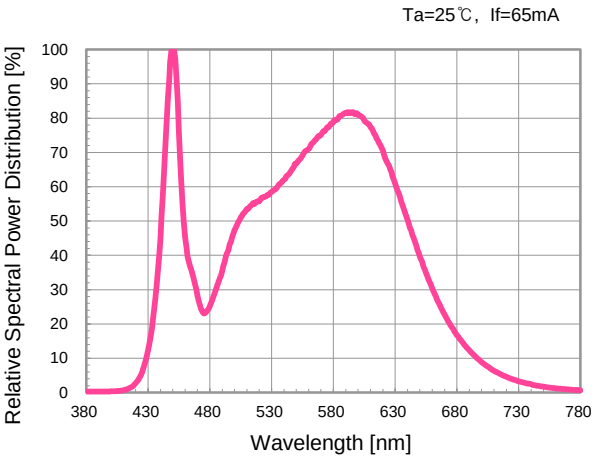
▪ Spectrum (5000K (H))



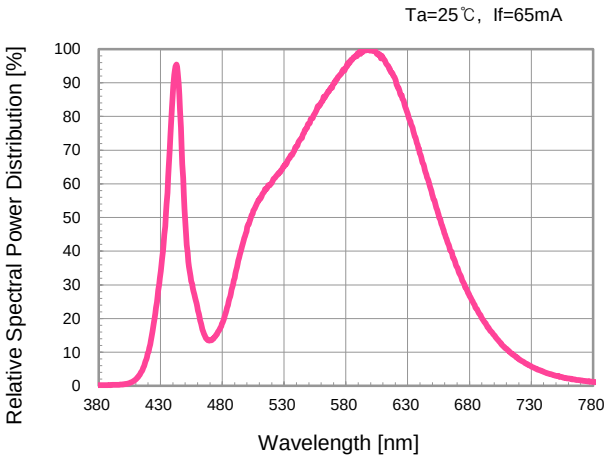
※ The Ta (ambient temperature) values for each graph are obtained with LG Innotek equipment.

7. Typical Characteristic Curves

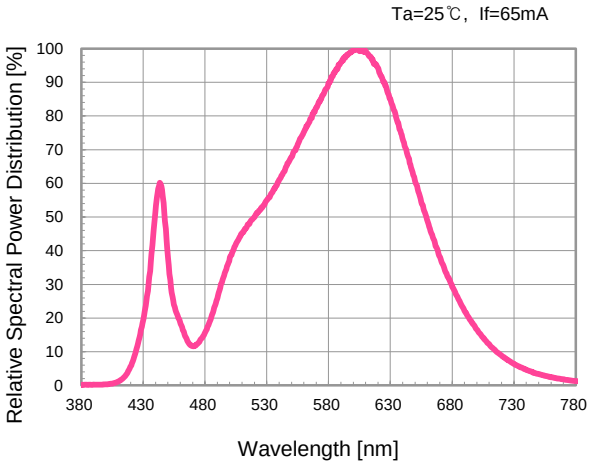
▪ Spectrum (4000K (J))



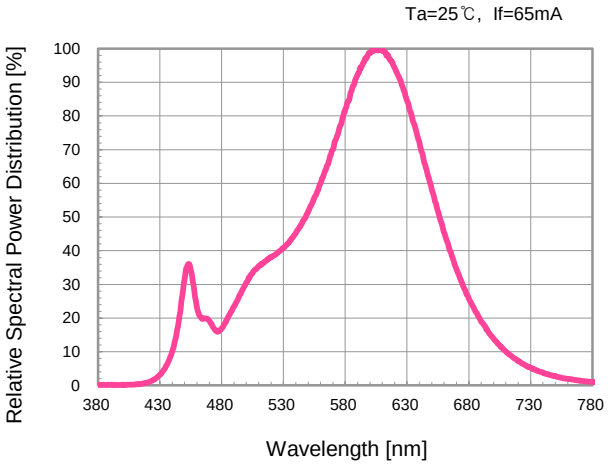
▪ Spectrum (3500K (K))



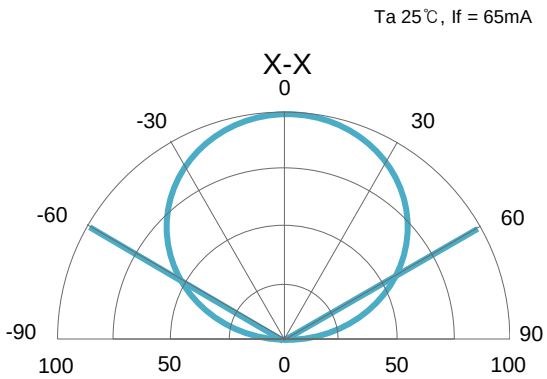
▪ Spectrum (3000K (L))

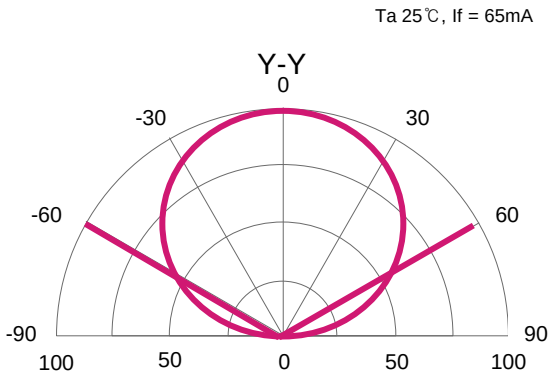


▪ Spectrum (2700K (M))



▪ Radiation Characteristics

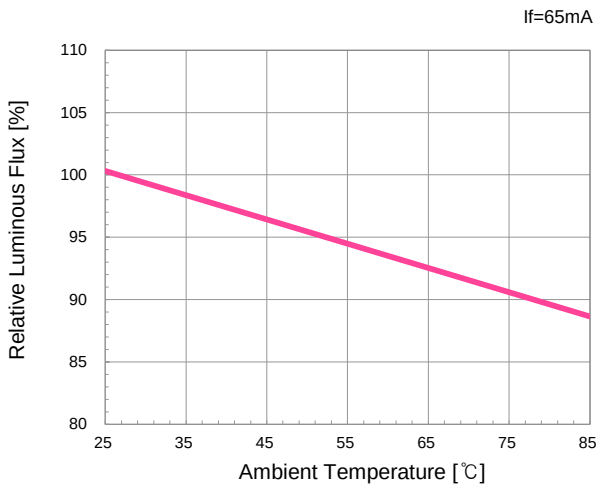




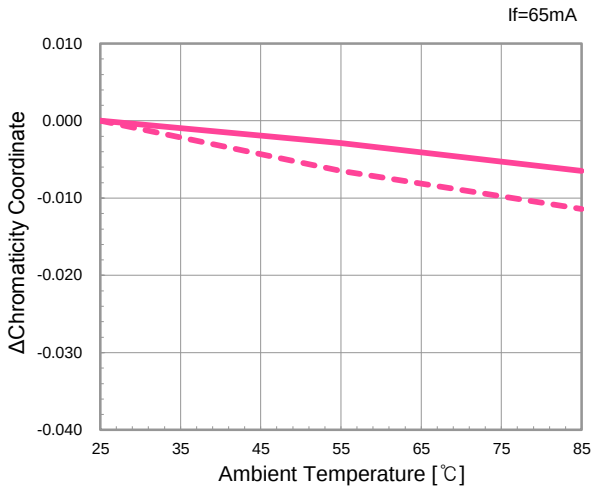
※ The Ta (ambient temperature) values for each graph are obtained with LG Innotek equipment.

7. Typical Characteristic Curves

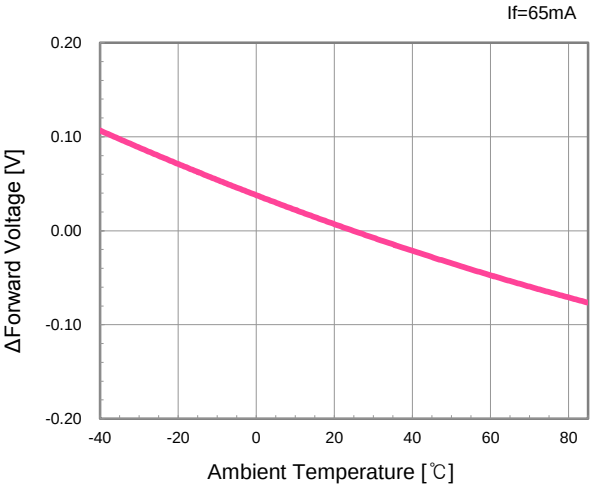
▪ Luminous Flux vs. Temperature



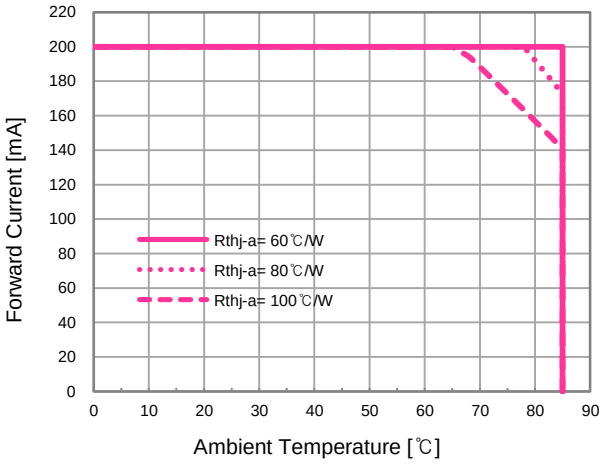
▪ Chromaticity Coordinate vs. Temperature



▪ Forward Voltage vs. Temperature



▪ Derating Curve



※ The Ta (ambient temperature) values for each graph are obtained with LG Innotek equipment.

8. Reliability Test Items and Conditions

8-1. Failure Criteria

Items	Symbols	Test Conditions	Criteria	
			Min.	Max.
Forward Voltage	Vf	If = 65mA	-	Initial Value × 1.1
Luminous Flux	Φ_V	If = 65mA	Initial Value × 0.7	-

8-2. Reliability Test

No	Items	Test Conditions	Test Hours /Cycles	Sample Size	Ac/Re
1	Room Temperature Operating Life (RTOL)	Ta = 25℃, If = 200mA	1,000 Hours	20 pcs	0/1
2	Wet High Temperature Operating Life (WHTOL)	Ta = 60℃, RH = 90% If = 200mA	1,000 Hours	20 pcs	0/1
3	High Temperature Operating Life (HTOL)	Ta = 85℃, If = 200mA	1,000 Hours	20 pcs	0/1
4	Low Temperature Operating Life (LTOL)	Ta = -40℃, If = 200mA	1,000 Hours	20 pcs	0/1
5	High Temperature Storage Life (HTSL)	Ta = 100℃	1,000 Hours	20 pcs	0/1
6	Low Temperature Storage Life (LTSL)	Ta = -40℃	1,000 Hours	20 pcs	0/1
7	Wet High Temperature Storage Life (WHTSL)	Ta = 85℃, RH = 85%	1,000 Hours	20 pcs	0/1
8	Temperature Cycle (TC)	-40℃(30min) ~ 100℃(30min)	100 Cycles	20 pcs	0/1
9	Moisture Sensitivity Level (MSL)	Tsld = 260℃ (Pre treatment 60℃,60% 168 hours)	3 Times	20 pcs	0/1
10	Vibration	100~2000~100Hz Sweep 4min. 200m/s², 3 directions	48 Minutes	20 pcs	0/1

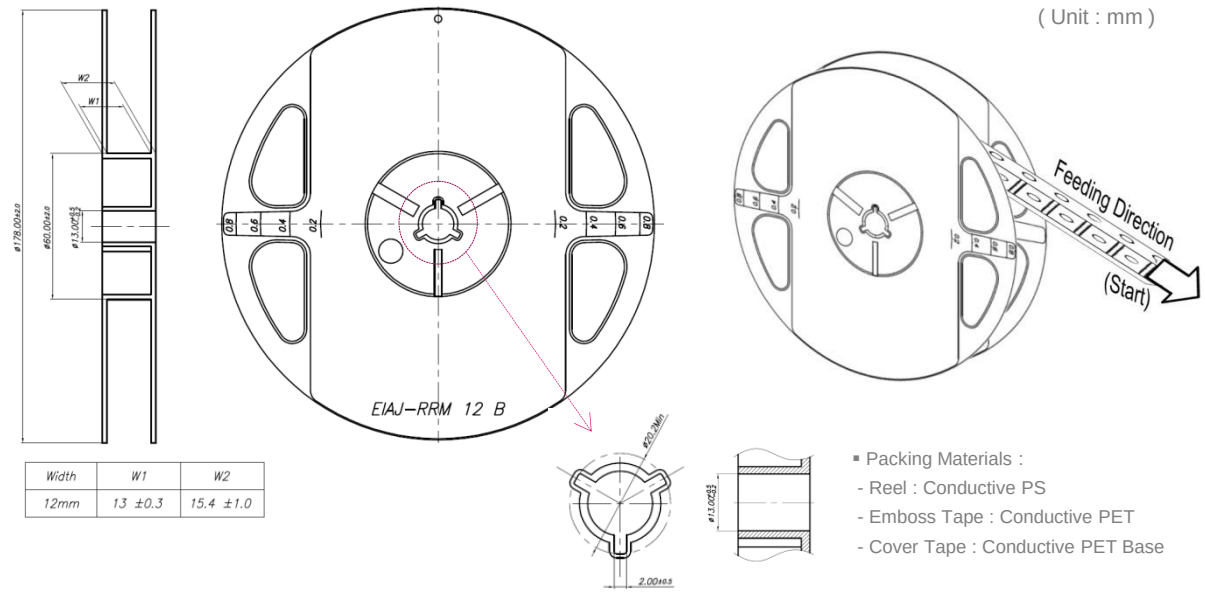
※ All samples are tested using LG Innotek Standard Metal PCB (25x25x1.6 mm^3(L×W×H)) except MSL test .
※ All samples must pass each test item and all test items must be satisfied.

9. Packing and Labeling of Products

9-1. Taping Outline Dimensions

▪ Reel

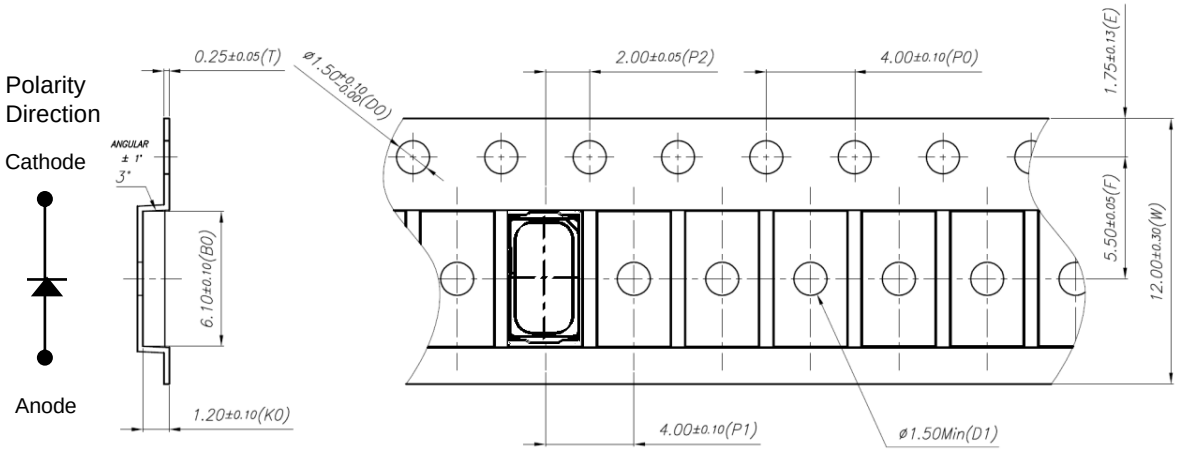
(Unit : mm)



Width	W1	W2
12mm	13 ±0.3	15.4 ±1.0

▪ Packing Materials :
- Reel : Conductive PS
- Emboss Tape : Conductive PET
- Cover Tape : Conductive PET Base

▪ Tape



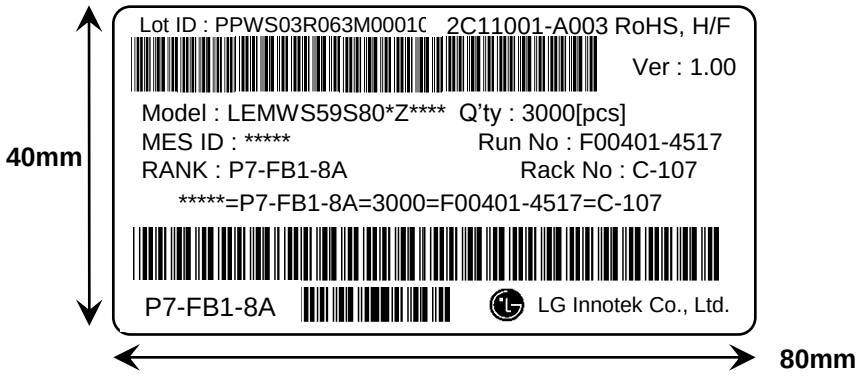
▪ Taping Arrangement

9. Packing and Labeling of Products

9-2. Label Structure

※. Label A

Specifying Model Name, Rank, Rack, Quantity and Run number



▪ Run No. indication

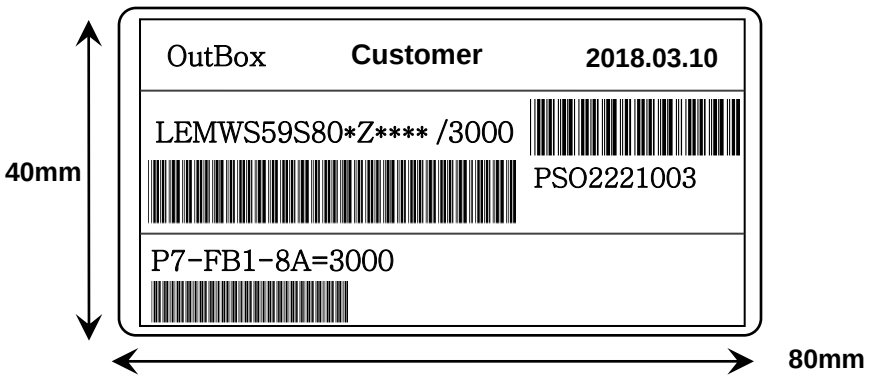
1	2	3	4	5	6	—	7	8	9	10
Code	Manufacture Site	Manufacture Year	Manufacture Month	Manufacture date			TP #		Serial No	
	Paju : 1 Huizhou : 9	2018 : 8 ... 2020 : 0 2021 : 1	1~9 : 1~9 10 : A 11 : B 12 : C	(01~31)			(00 ~ 99)		(00 ~ ZZ)	

9. Packing and Labeling of Products

9-2. Label Structure

※. Label C

Specifying Customer, Date, Model Name, Quantity, Customer Part no, Outbox ID, Rank/Rank Q'ty



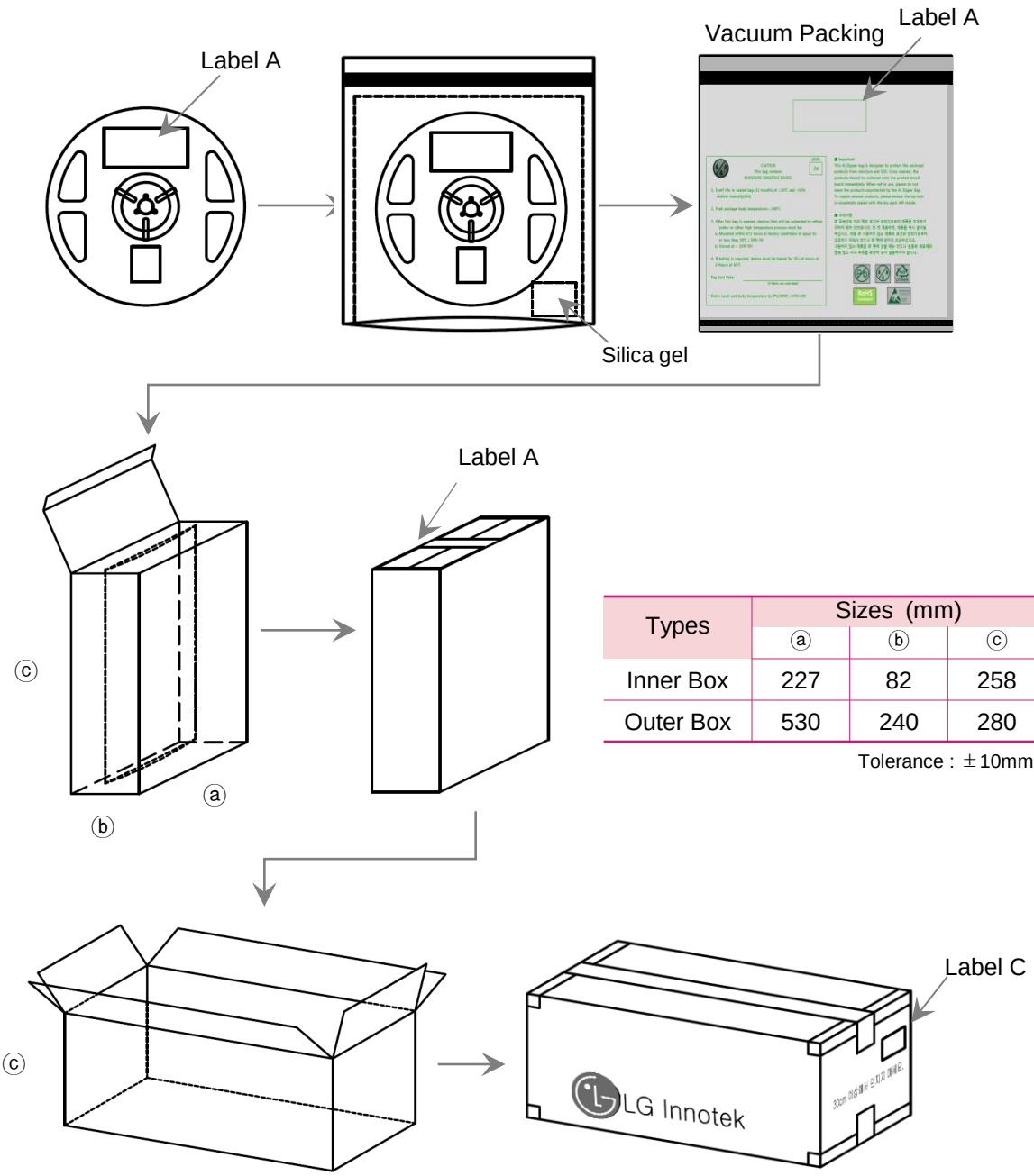
▪ Box ID. indication

1	2	3	4	5	6	7	8	9	10
Manufacture Site	PKG Site	Box	Year	Month	Date		Serial No		
Paju : P Huizhou : H	PKG : S, P	Inner Box : I Outer Box : O	2018 : 8 … 2020 : 0 2021 : 1	1~9 : 1~9 10 : A 11 : B 12 : C	(01 ~ 31)		(001 ~ 999)		

9. Packing and Labeling of Products

9-3. Packing Structures

Reeled products are packed in a sealed-off and moisture-proof aluminum bag with desiccants (silica gel). Max four aluminum bags are packed in an inner box and six inner boxes are packed in an outer box.



Types	Sizes (mm)		
	ⓐ	ⓑ	ⓒ
Inner Box	227	82	258
Outer Box	530	240	280

Tolerance : ±10mm

10. Cautions on Use

10-1. Moisture-Proof Package

-. The moisture in the SMD package may vaporize and expand during soldering.

-. The moisture can damage the optical characteristics of the LEDs due to the encapsulation.

10-2. During Storage

Conditions		Temperature	Humidity	Time
Storage	Before Opening Aluminum Bag	5℃ ~ 30℃	< 50%RH	Within 1 Year from the Delivery Date
	After Opening Aluminum Bag	5℃ ~ 30℃	< 60%RH	≤ 672 hours
Baking		65 ± 5℃	< 10%RH	10 ~ 24 hours

-. The LEDs should be stored in a clean environment. If the LEDs are stored for 3 months or more after being shipped from LGIT, a sealed container with a nitrogen gas should be used for storage.

-. When storing the LEDs after opening aluminum bag, reseal with a moisture absorbent material inside

10-3. During Usage

-. The LED should be avoided direct contact with hazardous materials such as sulfur, chlorine, phthalate, acid, solvent, etc. These materials(S, Cl, VOCs, etc.) may cause sulfurization of silver lead-frame or encapsulant silicone discoloration in LED.

VOCs(Volatile Organic Compounds) can be generated from adhesives glue, cleaning flux, molding hardener or organic additive which used in luminaires fixtures and they(VOCs) may cause a significant lumen degradation of LED in luminaires when they exposed to heat or light.

To prevent this phenomenon, materials used in luminaires must be carefully selected by users.

-. The metal parts(Including silver plated metal) on the LED can rust when exposed to corrosive gases. Therefore, exposure to corrosive gases must be avoided during operation and storage.

-. The metal parts(Including silver plated metal) also can be affected not only by the corrosive gases emitted inside of the end-products but by the gases penetrated from outside environment.

-. Extreme environments such as sudden ambient temperature changes or high humidity that can cause condensation must be avoided.

10-4. Cleaning

-. Do not use brushes for cleaning or organic solvents (i.e. Acetone, TCE, etc..) for washing as they may damage the resin of the LEDs.

-. Isopropyl Alcohol(IPA) is the recommended solvent for cleaning the LEDs under the following conditions.

Cleaning Condition : IPA, 25℃ max. × 60sec max.

-. Ultrasonic cleaning is not recommended.

-. Pretests should be conducted with the actual cleaning process to validate that the process will not damage the LEDs.

10. Cautions on Use

10-5. Thermal Management

-. The thermal design of the end product must be seriously considered, particularly at the beginning of the system design process.

-. The generation of heat is greatly impacted by the input power, the thermal resistance of the circuit boards and the density of the LED array combined with other components.

10-6. Static Electricity

-. Wristbands and anti-electrostatic gloves are strongly recommended and all devices, equipment and machinery must be properly grounded when handling the LEDs, which are sensitive against static electricity and surge.

-. Precautions are to be taken against surge voltage to the equipment that mounts the LEDs.

-. Unusual characteristics such as significant increase of current leakage, decrease of turn-on voltage, or non-operation at a low current can occur when the LED is damaged.

10-7. Recommended Circuit

-. The current through each LED must not exceed the absolute maximum rating when designing the circuits.

-. In general, there can be various forward voltages for LEDs. Different forward voltages in parallel via a single resistor can result in different forward currents to each LED, which also can output different luminous flux values. In the worst case, the currents can exceed the absolute maximum ratings which can stress the LEDs. Matrix circuit with a single resistor for each LED is recommended to avoid the luminous flux fluctuations.

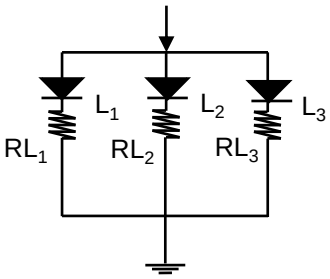


Fig.1 Recommended Circuit in Parallel Mode
: Separate resistors must be used for each LED.

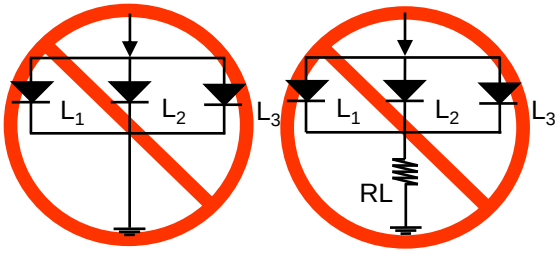


Fig.2 Abnormal Circuit
Circuits to Avoid : The current through the LEDs may vary due to the variation in LED forward voltage.

-. The driving circuits must be designed to operate the LEDs by forward bias only.

-. Reverse voltages can damage the zener diode, which can cause the LED to fail.

-. A constant current LED driver is recommended to power the LEDs.

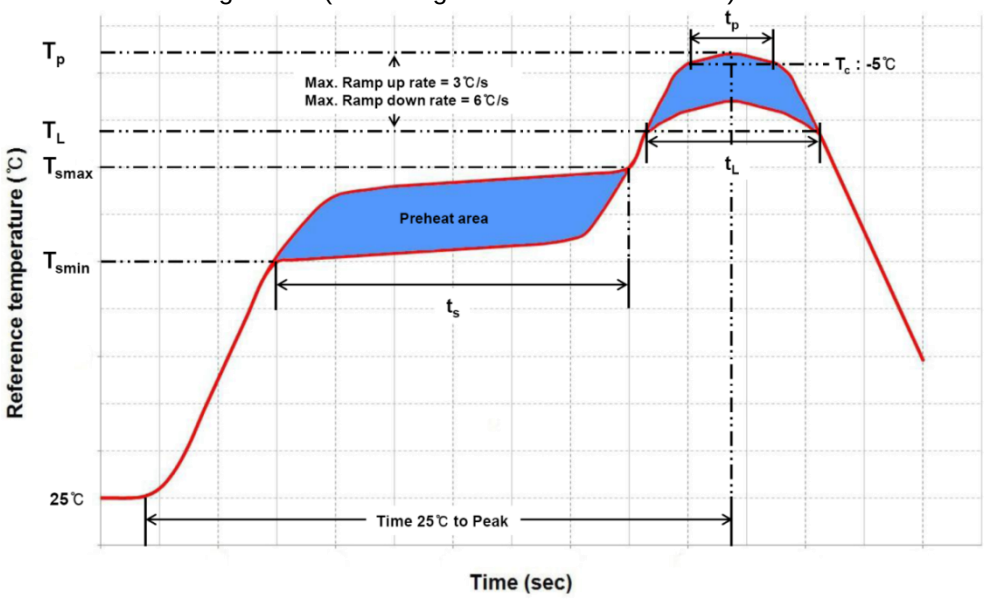
10. Cautions on Use

10-8. Soldering Conditions

-. Reflow soldering is the recommended method for assembling LEDs on a circuit board.

-. LG Innotek does not guarantee the performance of the LEDs assembled by the dip soldering method.

-. Recommended Soldering Profile (according to JEDEC J-STD-020D)



Profile Feature	Pb-Free Assembly	Pb-Based Assembly
Preheat / Soak Temperature Min (T_{smin}) Temperature Max (T_{smax}) Maximum time(t_s) from T_{smin} to T_{smax}	 150℃ 200℃ 60~120 seconds	 100℃ 150℃ 60~120 seconds
Ramp-up rate (T_L to T_p)	3℃/ second max.	3℃/ second max.
Liquidus temperature (T_L)	217℃	183℃
Time (t_L) maintained above T_L	60~150 seconds	60~150 seconds
Maximum peak package body temperature (T_p)	260℃	235℃
Time(t_p) within 5℃ of the specified temperature (T_c)	30 seconds	20 seconds
Ramp-down rate (T_p to T_L)	6℃/second max.	6℃/second max.
Maximum Time 25℃ to peak temperature	8 minutes max.	6 minutes max.

-. Reflow or hand soldering at the lowest possible temperature is desirable for the LEDs although the recommended soldering conditions are specified in the above diagrams.

-. A rapid cooling process is not recommended for the LEDs from the peak temperature.

-. The silicone encapsulant at the top of the LED package is a soft surface, which can easily be damaged by pressure. Precautions should be taken to avoid strong pressure on the silicone resin when leveraging the pick and place machines.

-. Reflow soldering should not be done more than two times.

10. Cautions on Use

10-9. Soldering Iron

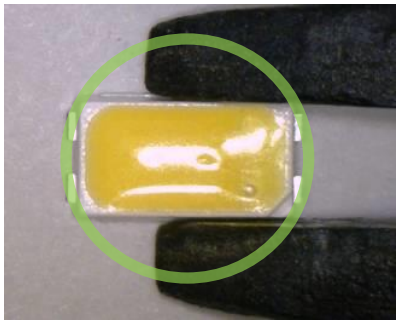
-. The recommended condition is less than 5 seconds at 260℃.
-. The time must be shorter for higher temperatures. (+10℃ → -1sec).
-. The power dissipation of the soldering iron should be lower than 15W and the surface temperature of the device should be controlled at or under 230℃.

10-10. Eye Safety Guidelines

-. Do not directly look at the light when the LEDs are on.
-. Proceed with caution to avoid the risk of damage to the eyes when examining the LEDs with optical instruments.

10-11. Manual Handling

-. Use Teflon-type tweezers to grab the base of the LED and do not apply mechanical pressure on the surface of the encapsulant.



11. Disclaimers

-. LG Innotek is not responsible for any damages or accidents caused if the operating or storage. conditions exceed the absolute maximum ratings recommended in this document.
-. The LEDs described in this document are intended to be operated by ordinary electronic equipment.
-. The LEDs should not be used at any lighting products together with the other LEDs, which has a different part number. If required, please contact any sales person.
-. It is recommended to consult with LG Innotek when the environment or the LED operation is non-standard in order to avoid any possible malfunctions or damage to product or risk of life or health.
-. Disassembly of the LED products for the purpose of reverse engineering is prohibited without prior written consent from LG Innotek. All defected LEDs must be reported to LG Innotek and are not to be disassembled or analyzed.
-. The product information can be modified and upgraded without prior notice.

Appendix. Nomenclature of Package

All LEDs are tested and sorted by color, luminous flux and forward voltage where every LED in a tube has only a single color bin, luminous flux bin and forward voltage bin.
However, the forward voltage bin information is not captured in the part number nomenclature.
A 16-digit part number is required when orders are placed. LG Innotek leverages the following part number nomenclature.